Claims

[1] A method of recycling a fluorescent lamp, the method comprising:
heating broken pieces of fluorescent lamps at a temperature of about 100℃ to about 330℃ to form a gas containing a mercury vapor;
cooling the gas containing the mercury vapor at a temperature of about -38℃ to about 0℃ to form a liquid mercury; and
collecting the liquid mercury.

[2] The method of claim 1, prior to forming of the gas containing the mercury vapor, further comprising breaking the fluorescent lamps.

[3] The method of claim 2, wherein a size of each of the broken pieces of the fluorescent lamps is no larger than about 5cm.

[4] The method of claim 2, further comprising guiding a gas ejected from the broken pieces of the fluorescent lamps and particles of the broken pieces of the fluorescent lamps into the first collection container.

[5] The method of claim 1, further comprising transporting the gas containing the mercury vapor from the broken pieces of the fluorescent lamps by a pre-determined distance.

[6] The method of claim 5, after the gas containing the mercury vapor is transported, further comprising pre-cooling the gas containing the mercury vapor using the cooled gas.

[7] The method of claim 5, wherein a gas flow of the gas containing the mercury vapor corresponds to a laminar flow.

[8] The method of claim 1, further comprising filtering a remaining gas from which the liquid mercury is removed.

[9] A method of recycling a fluorescent lamp, the method comprising:
breaking fluorescent lamps using two rollers that rotate in opposite directions to each other;
collecting broken pieces of the fluorescent lamps under the rollers;
heating the collected broken pieces of the fluorescent lamps at a temperature of about 100℃ to about 300℃ to generate a gas containing a mercury vapor;
transporting the gas containing the mercury vapor to a condensing part having a spiral shape having a spiral axis that is substantially parallel with a direction of gravitational force;
cooling the gas in the condensing part at a temperature of about -20℃ to about

0°C to liquefy the mercury vapor;
collecting the liquid mercury; and
filtering a remaining gas from which the liquid mercury is removed.

[10] A method of recycling a fluorescent lamp, the method comprising:
breaking fluorescent lamps using two rollers that rotate in opposite directions to each other;
collecting broken pieces of the fluorescent lamps under the rollers;
heating the collected broken pieces of the fluorescent lamps at a temperature of about 100°C to about 300°C to generate a gas containing a mercury vapor;
transporting the gas containing the mercury vapor to a heat exchanger so as to pre-cool the transported gas;
transporting the pre-cooled gas to a condensing part having a spiral shape having a spiral axis that is substantially parallel with a direction of gravitational force;
cooling the gas in the condensing part at a temperature of about -20°C to about 0°C to liquefy the mercury vapor;
collecting the liquid mercury;
transporting a remaining gas from which the liquid mercury is removed to a heat exchanger; and
filtering the remaining gas that passes through the heat exchanger.

[11] A recycling apparatus comprising:
a first collection container that collects broken pieces of fluorescent lamps;
a heater disposed adjacent to the first collection container to heat the first collection container to form a gas containing a mercury vapor;
a tubular unit that includes a connecting part connected to the first collection container and a condensing part connected to the connecting part to have a spiral shape having a spiral axis that is substantially parallel with a direction of gravitational force, the tubular unit guiding the gas containing the mercury vapor;
a cooler that surrounds the condensing part to cool the gas in the condensing part to liquefy the mercury vapor;
a second collection container disposed under the condensing part to collect the liquid mercury; and
a pump connected to the condensing part to aspirate the gas.

[12] The recycling apparatus of claim 11, further comprising a breaker disposed over the first collection container to break the fluorescent lamps.

[13] The recycling apparatus of claim 12, wherein the breaker comprises two rollers

that rotate in opposite directions to each other.

[14] The recycling apparatus of claim 13, wherein a distance between outer surfaces of the rollers is no greater than about 5cm.

[15] The recycling apparatus of claim 12, further comprising a blower that guides a gas ejected from the broken pieces of the fluorescent lamps and particles of the broken pieces of the fluorescent lamps toward the first collection container.

[16] The recycling apparatus of claim 11, further comprising a cover disposed on the first collection container to open and close an upper opening of the first collection container.

[17] The recycling apparatus of claim 16, wherein the cover seals the upper opening of the first collection container in case that the cover is closed, and the first collection container includes an inlet disposed at the first collection container opposite to the connecting part.

[18] The recycling apparatus of claim 17, wherein the inlet comprises a valve controlling an amount of an air that is provided from an exterior the first collection container.

[19] The recycling apparatus of claim 11, further comprising a third collection container disposed under the first collection container to collect the liquid mercury.

[20] The recycling apparatus of claim 11, wherein the heater comprises an electric heater.

[21] The recycling apparatus of claim 11, wherein the heater heats the first collection container at a temperature of about 100°C to about 300°C.

[22] The recycling apparatus of claim 11, wherein a diameter of the connecting part is greater than a diameter of the condensing part.

[23] The recycling apparatus of claim 11, wherein the condensing part comprises two spiral tubes that are parallelly connected to form an U-shaped condensing part.

[24] The recycling apparatus of claim 11, wherein the condensing part comprises four spiral tubes that are parallelly connected to form a W-shaped condensing part, and the recycling apparatus includes two collection containers disposed under the condensing part.

[25] The recycling apparatus of claim 11, wherein the condensing part comprises '2n' spiral tubes that are parallelly connected, the recycling apparatus includes 'n' collection containers disposed under the condensing part, and 'n' is a positive integer.

[26] The recycling apparatus of claim 11, wherein the condensing part comprises a metal sieve disposed corresponding to the second collection container.

[27] The recycling apparatus of claim 11, wherein the tubular unit further comprises a heat exchanging part disposed between the condensing part and the pump adjacent to the connecting part so as to exchange heat with the connecting part.

[28] The recycling apparatus of claim 11, wherein the cooler cools the gas in the condensing part at a temperature of about -20°C to about 0°C.

[29] The recycling apparatus of claim 11, wherein the pump comprises a filter filtering the gas that passes through the pump.

[30] The recycling apparatus of claim 29, wherein the filter further comprises an activated carbon or a cotton filter.

[31] The recycling apparatus of claim 11, wherein a gas flow of the gas containing the mercury vapor corresponds to a laminar flow.

[32] The recycling apparatus of claim 31, wherein a specific capacitor of the pump is no more than about 100l/min.

[33] The recycling apparatus of claim 11, wherein the pump comprises a rotary pump.